

# MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

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## INTRODUCTION.

The REVIEW for March, 1897, is based on 2,764 reports from stations occupied by regular and voluntary observers, classified as follows: 142 from Weather Bureau stations; numerous special river stations; 33 from post surgeons, received through the Surgeon General, U. S. Army; 2,547 from voluntary observers; 96 received through the Southern Pacific Railway Company; 14 from Life-Saving stations, received through the Superintendent United States Life-Saving Service; 32 from Canadian stations; 1 from Hawaii; 20 from Mexican stations. International simultaneous observations are received from a few stations and used together

with trustworthy newspaper extracts and special reports.

The WEATHER REVIEW is prepared under the general editorial supervision of Prof. Cleveland Abbe. Unless otherwise specifically noted, the text is written by the Editor, but the meteorological tables contained in the last section are furnished by Mr. A. J. Henry, Chief of the Division of Records and Meteorological Data. Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada, Mr. Curtis J. Lyons, Meteorologist to the Government Survey, Honolulu, and Dr. Mariano Bárcena, Director of the Central Meteorological Observatory of Mexico.

## CLIMATOLOGY OF THE MONTH.

### GENERAL CHARACTERISTICS.

The month was remarkable for the general character of the paths of the storm centers; for the high winds of the 12th and 14th in the lower Lake Region and on the middle Atlantic Coast and 25th and 27th on the coast of Oregon and Washington; for the heavy snows in the Rocky Mountain Region; for the remarkable rains in the watershed of the lower Mississippi and its tributaries, culminating in a region of 18 inches of rain in the Valley of the Tennessee and causing most destructive floods in the Mississippi River; the abnormally low temperatures in the Dakotas and the Canadian Northwest Provinces and westward to the Pacific Coast; the high temperatures in the Gulf States.

### ATMOSPHERIC PRESSURE.

[In inches and hundredths.]

The distribution of mean atmospheric pressure reduced to sea level, as shown by mercurial barometers, not reduced to standard gravity, and as determined from observations taken daily at 8 a. m. and 8 p. m. (seventy-fifth meridian time), is shown by isobars on Chart IV. That portion of the reduction to standard gravity that depends on latitude is shown by the numbers printed on the right-hand border.

The mean pressure during the current month was highest off the south Atlantic Coast and high in Manitoba, Athabasca, and Saskatchewan. It was lowest in Newfoundland and low off the coast of Oregon. The reduced pressures were highest: In the United States, Charleston, S. C., 30.16; Savannah, Wilmington, Raleigh, and Norfolk, 30.14. In Canada, White River, 30.13; Battleford and Swift Current, 30.12. The lowest were: In the United States, Tatoosh Island, 29.87. In Canada, St. Johns, N. F., 29.77.

As compared with the normal for March, the mean pressure

was in excess in the Atlantic States and Lake Region, but was deficient on the Pacific Coast. The greatest excesses were: In the United States, Eastport and Block Island, 0.12; Boston, 0.10. In Canada, Yarmouth, 0.10; Edmonton, 0.08; Charlottetown, Chatham, Quebec, Montreal, and Rockcliffe, 0.06. The greatest deficits were: In the United States, Tatoosh Island and Fort Canby, 0.15; Concordia, 0.14; Corpus Christi and San Antonio, 0.13; Palestine, 0.12. In Canada, St. Johns, N. F., 0.06; Winnipeg, 0.03; Calgary, 0.02.

As compared with the preceding month of February, the pressures reduced to sea level show a rise on the south Atlantic Coast, as also in the Canadian Northwest Territories and upper Lake Region, but a decided fall in the west Gulf States, southern Plateau Region, and north Pacific Coast. The greatest rises were: In the United States, Norfolk, Hatteras, Raleigh, Wilmington, Charleston, Williston, Havre, and Miles City, 0.05; Kittyhawk, Charlotte, Savannah, and Duluth, 0.04. In Canada, Swift Current, 0.07; Qu'Appelle and St. Johns, N. F., 0.04. The greatest falls were: In the United States, Rapid City, 0.13; Pueblo and Santa Fe, 0.12; Denver Dodge City, and San Antonio, 0.11. In Canada, Quebec and Montreal, 0.06; Kingston, 0.05; Chatham, Father Point, Kingston, and Toronto, 0.04.

### AREAS OF HIGH AND LOW PRESSURE.

By Prof. H. A. HAZEN.

During March six high pressure areas and twelve lows were sufficiently well defined to be traced, and their paths are shown on Charts I and II of this REVIEW. As a general thing, the center of the high area can not be determined with the same accuracy as that of the low, and in consequence the paths of the highs are not as definite as those of the lows. The accompanying table gives the principal facts as to the date and location of each high and low, with the duration

and length of path and apparent velocity of translation. The following particulars are added:

## HIGHS.

The highs have come from the region north of Montana, with a single exception, No. VI, which was first noted to the north of Lake Superior. Their translation was generally a little south of east, Nos. III, IV, V, and VI disappearing in the middle Atlantic or merging in the subpermanent high in that region. Nos. I and II moved northeast near the Atlantic Coast, and were last noted off Nova Scotia. There were no notable cold waves accompanying any of these high areas. The greatest fall in temperature in twenty-four hours within the United States was 36°, at Huron p. m. of 5th, while high No. II was situated to the north of Montana. A fall of 34° occurred at Oklahoma a. m. of 12th, while high area No. III was to the north of Montana.

## LOWS.

The most remarkable fact about the low areas of this month is the origin of Nos. I, IV, V, VII, VIII, XI, and XII either on the middle Rocky Mountain crest or else a little east of there. These have been especially studied, and will be described at another time. Storms No. III and X were first noted on the north Pacific Coast, Nos. II and VI to the north of Montana, and No. IX in south Texas. Of these storms Nos. VI and X disappeared to the north of Montana or near Manitoba, No. VII to the north of Lake Superior, Nos. XI and XII in the middle Mississippi Valley, and all the rest traversed the Lake Region and disappeared in the Gulf of St. Lawrence or off Newfoundland, where there was a subpermanent low pressure area during the month. The highest wind of the month (76 miles per hour from the west) was reported from Buffalo p. m. of the 12th, while storm No. IV was central in the St. Lawrence Valley. The same station reported 68 miles west on the evening of the 14, as storm No. VI approached the mouth of the St. Lawrence.

The accompanying table presents the principal facts regarding the place of origin and disappearance of these highs and lows.

*Movements of centers of areas of high and low pressure.*

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
<b>High areas.</b>										
I.....	1, a. m.	52	114	5, p. m.	45	58	Miles.	Days.	Miles.	Miles.
II.....	4, a. m.	54	114	9, a. m.	46	58	3,470	4.5	771	32.1
III.....	13, a. m.	50	110	15, p. m.	38	77	2,930	5.0	584	24.3
IV.....	14, a. m.	51	106	17, p. m.	36	74	3,410	3.5	689	28.7
V.....	20, p. m.	50	114	23, p. m.	35	75	2,280	3.5	651	27.1
VI.....	23, a. m.	49	85	30, a. m.	34	73	3,220	8.0	404	16.8
							1,300	2.0	600	25.0
Total.....							15,510	26.5	3,699	
Mean of 6 tracks.....							2,585	4.4	616	25.7
Mean of 26.5 days.....									585	24.4
<b>Low areas.</b>										
I.....	1, p. m.	35	100	4, a. m.	47	61	3,100	2.5	840	35.0
II.....	3, a. m.	58	114	6, a. m.	49	67	2,800	3.0	932	38.8
III.....	4, a. m.	52	122	11, a. m.	47	59	4,180	7.0	597	24.9
IV.....	10, p. m.	39	104	13, p. m.	48	53	2,530	3.0	844	35.3
V.....	13, p. m.	38	90	15, a. m.	49	55	1,930	1.5	1,280	53.3
VI.....	14, p. m.	53	117	19, a. m.	52	97	1,240	4.5	275	11.5
VII.....	15, a. m.	45	107	30, p. m.	48	84	1,530	2.5	607	25.3
VIII.....	20, p. m.	36	102	23, p. m.	47	63	2,180	2.5	871	36.3
IX.....	21, p. m.	28	100	26, p. m.	46	53	2,990	5.0	598	24.9
X.....	26, p. m.	34	111	29, p. m.	35	98	890	2.5	355	14.8
XI.....	27, a. m.	45	127	30, p. m.	54	109	1,160	2.5	466	19.4
XII.....	29, a. m.	41	107	*	36	91	920	3.0	306	12.8
Total.....							24,430	39.5	7,973	
Mean of 13 tracks.....							2,086	3.3	604	27.7
Mean of 37 days.....									618	25.7

\*April 1, a. m.

## LOCAL STORMS.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

The record of local storms for January, February, and March is as follows:

January 2.—Tornadoes wrecked the small villages of Mooringsport, La., and Benton, Ark., on the afternoon of January 2, 1897. Five people were killed at Mooringsport and 21 were injured; the property loss was about \$6,000; path of storm, 300 yards wide; length, unknown; movement, northeast; time, 3.45 p. m., ninetieth meridian. The tornado at Benton, Ark., was much more destructive to property, although but one life was lost. The total property loss was estimated at \$12,000 in the town and a much larger sum for the county. Details as to the latter, however, are wanting. The path of the storm was 100 yards wide; length, unknown; movement, northeast; time, about 7 p. m., ninetieth meridian.

The meteorological conditions on the above date were not greatly different from those which generally obtain during the occurrence of tornadoes. A shallow depression covered the west Gulf States, the lowest reduced pressure at 8 p. m., seventy-fifth meridian time, being about 29.80 inches. Rain was falling in Louisiana, Arkansas, Mississippi, and Missouri, and snow, with temperature below freezing, in southern Kansas. The temperature was more than 20° above the normal of the season at Shreveport and Little Rock, the nearest points of observation to the scene of destruction. The barograph curve at Little Rock, about 20 miles northeast of Benton, shows an abrupt rise of about 0.08 inch at the time the tornado struck the last-named place. The increased pressure was maintained for about two hours and fifteen minutes, when an equally abrupt fall occurred, after which the pressure continued to rise and fall in short oscillations of about 0.05 inch amplitude for a period of about fourteen hours.

February 21.—A diminutive tornado was reported to have occurred near Benwood, Clay County, Ind., on the evening of February 21, 1897. The path of the storm was estimated to be about 100 yards wide and 3 miles long. The damage was not great. The meteorological conditions on February 21 were not such as are generally noted in connection with tornadoes. A correspondent of the Bureau writing from Terre Haute, 15 miles southwest of Benwood, says:

About 8 o'clock Sunday morning (the 21st) the wind suddenly shifted from the south or southwest to the northwest, blowing quite strong, accompanied with round snow, enough to make the ground quite white. At the same time there was a great deal of thunder. In the course of an hour the wind veered to the north and northeast, the snow changing into a cold rainstorm, which continued hard and steady, with very few cessations, until dark. The air was raw and chilly here at Terre Haute all day.

At the time this tornado occurred Benwood was in the northeast quadrant of a somewhat oval-shaped depression that covered Missouri and the west Gulf States. The temperature at Benwood was probably not greatly above 40°, if it reached that figure. Snow was falling in Iowa. The region of warm, moist, southerly winds, so far as can now be ascertained from the daily weather maps, did not reach the southern border of Indiana.

March 5.—Violent squall winds prevailed over north-central Texas, Arkansas, Tennessee, and Kentucky during the 5th. Fifteen buildings were wrecked at Frost, Tex., and 4 persons were injured. Property loss, \$4,000. Hope, Ark., also suffered a loss to buildings estimated at \$15,000. Damage to roofs and frail structures was reported from a number of places in Tennessee and Kentucky.

March 9.—A severe hailstorm occurred at Evansville, Ind., hail the size of pigeon's eggs fell for five minutes.

March 11.—Hailstones varying in diameter from  $\frac{1}{4}$  to  $\frac{1}{2}$  inch fell at Nashville, Tenn., for a period of six minutes. The accompanying rainfall was very heavy and, it is said, the fury